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AGRICULTURAL LEDGER.

1895—No. II.

AGRICULTURAL IMPROVEMENTS.

[DICTIONARY OF ECONOMIC PRODUCTS, Vol. I., A. 647a.]

THE NAGPORE EXPERIMENTAL FARM.

Note by DR. J. W. LEATHER, Agricultural Chemist to the Government of India.

Other PAPERS that may be consulted :

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E. C. BUCK,
Secretary to the Government of India.

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[*Dictionary of Economic Products, Vol. I., A. 647a.*].

THE NAGPORE EXPERIMENTAL FARM.

Note by DR. J. W. LEATHER, Agricultural Chemist to the Government of India.

This Experimental Farm was established in 1883, in which year the former Model Farm was given up, and the present site selected in its stead. The land is close to Nagpore and is conveniently situated either for inspection by the Director of Agriculture or for visits which may be paid by neighbouring cultivators.

It consists of a fairly level piece of land of about 90 acres in extent, and is probably as well suited to the purpose as any that could be obtained. The soil is all "black cotton soil."

2. The description of work undertaken at the new farm has been of a much more precise nature than at the former one; and an advantage has doubtless been gained by the change.

The experimental work may be classed under the heads (a) testing the value of new crops, (b) testing the value of different manures, (c) the applicability of new implements to Indian Agriculture, (d) methods of cultivation and rotation of crops.

3. But in addition to this, which may be classed under the head of experimental work proper, three other matters have been taken in hand by the Director of Agriculture, namely, the better utilisation of night-soil for agricultural purposes; an agricultural school has been established; and more recently an area has been taken up for the growth of fire-wood.

Although these may be considered as distinct from the farm, the two former are carried on at the same site and are included by the Director in his Annual Reports of the Farm. I deem it proper, therefore, to refer to them also in this note.

4. The Farm, with its accompaniments, the School and Disposal of Night-soil are in the charge of the Commissioner of Settlements and Agriculture. The details of the work are placed in the hands of a Superintendent, who also is placed in charge of the School.

The details, whether of labour or of weights of crops, are primarily entered in rough note-books (which are *not* destroyed), and from these they are entered in the "Cultivation Book." In this two pages are

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reserved for each plot and the details of labour and outturn with any remarks are herein entered. The *results* contained in this book are further transferred to the "Field History Book" in which the crop of each plot, its treatment and outturn, etc., are entered consecutively for the whole series of years, thus enabling one at a glance to see what the treatment of any plot has been in the past. The results of the experiments are annually published in a separate Report. Under the head of Management I do not think that I can suggest any improvement. If the farm always has such capable guidance as that which Mr. Fuller has bestowed upon it in the past, and such an energetic and capable Superintendent as the present one, it may safely be assumed that the work will be of a useful nature.

The method of keeping the farm records is in every way suitable.

5. I now pass to a brief description of the experiments which I will take in the order above indicated (paragraph 2).

(a) Among new crops which have been grown experimentally on the farm may be mentioned:—American Cottons and Cottons from other parts of India, American Maize, *Sorghum Saccharatum*, Wheats, *Juar*, Guinea Grass. Of these the following may be referred to:—

6. *Sorghum Saccharatum* was grown in 1883, 1885 and 1886. This plant has been strongly recommended in America as an economic sugar-producer. It occupies the land for five or six months only and requires generally no artificial irrigation. It is, therefore, a much cheaper crop to grow than sugarcane. The crops of 1885 and 1886 were seasonably harvested; and the juice was very carefully evaporated in a Cook's Evaporator, but very little crystallisable sugar was obtained.

7. Three varieties of American Maize were grown experimentally in 1883, two of which, "Golden Dent" and "Marylair" or "Late Corn," were considered to deserve an extended trial. They were cultivated in 1884 and 1885, and some of the cultivators in the neighbourhood have continued to grow them. The Golden Dent variety appears to have succeeded best.

8. *Exotic Cottons*.—Among these, Upland Georgian, New Orleans, Louisiana, Prolific, Sea Island, have all been grown experimentally, but none of them have given much promise of success excepting the Upland Georgian. This variety has been grown each year since the farm was established and is still cultivated.

The outturns have been as follows. The figures are in terms of pounds of cleaned cotton per acre:—

		Upland Georgian.	Buni.	Yars.
1883	Manured	186
	Unmanured	40	58	31
1884	M.	41	26	} (v. heavy mon. soon rains.)
	U.	8	12	
1885	M.	103
	U.	100
1886	M.	174
	U.	85

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	Upland Georgian.	Bani.	Yari.	Exotic Cottons.
1887	{ M. . . .	65	{ (heavy rains.)	...
	{ U. . . .	36		...
1888	{ M. . . .	138
	{ U. . . .	124
1889	{ M. . . .	105
	{ U. . . .	79	160	...
1890	{ M. . . .	84	90	156
	{ U.
1891	{ M. . . .	58	47	64
	{ U.
1892	{ M. . . .	86	94	110
	{ U.

This statement shows the outturn of the Upland Georgian and the local varieties which have been grown on neighbouring plots of land for the sake of comparison.

9. The Upland Georgian variety has been valued by cotton spinners on several occasions. The crop of 1883 was valued at Rs 78 per 340lb as against Rs 72 for the *Bani* and Rs 58 for the *Yari*; that grown in 1885 was considered superior to the Hinganghat variety; in 1890 the valuations were Rs 79 for Upland Georgian, Rs 70 for *Bani* and Rs 50 for *Yari* per bojha of 345lb; in 1891 the valuations were Rs 79, Rs 74 and Rs 50, respectively, and in 1892 the Upland Georgian and *Bani* were valued at Rs 100, the *Yari* at Rs 88 per bojha of 345lb.

10. Seed of this variety (Upland Georgian) was distributed to some of the cultivators of the Wardha District in 1885, 1886, 1887, 1888, and in 1889. At first the results were hopeful, and in 1889 the Deputy Commissioner was able to report that "they (the ryots) are unanimous in saying that the cotton is whiter than the ordinary country kind and yields a larger proportion of cleaned cotton," but it appears from the Report of 1889-90 (page 4) that the cultivators had mixed up the seed with the indigenous varieties, thus preventing definite information from being gained as to the outturn, etc.

11. Of the varieties locally cultivated, the *Bani* and *Yari* have been grown a number of times, and their average outturns of clean cotton per acre are given in the above statement (paragraph 8).

It will be seen that the outturn of the *Yari* variety is higher than that of either *Bani* or Upland Georgian. After valuation of the crops in 1891, the Superintendent of the Farm draws the following conclusion:—

"Taking the value realised per acre into account, the difference, though not so very great, is more than sufficient to account for the superior varieties being driven out of the market. *Yari* has yielded 22 per cent. more in value than *Bani* and 18 per cent. more than Upland Georgian.

"It should be noticed here that, though Upland Georgian has given less in outturn, it has realised better value than *Bani*. I am informed on very good authority that the present price of *Yari* is more than its intrinsic worth, owing to its being largely used for adulterating superior varieties. If means be adopted to check this

Local varieties of cotton.

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fraudulent mixing of inferior with good varieties, it would then be interesting to see whether the better varieties could not hold their own against *Jari*, in spite of the latter's larger outturn. I am informed that during the year under report, *Jari* was grown to such a large extent at the expense of *Bani* that its price fell to something of its real value, and cultivators who had grown *Bani* realised better profits than those who had put their faith in *Jari* alone."

And again in the following year the position of the *Jari* variety is thus stated (*vide* page 4 of the Farm Report, 1891-92):—

"The commonly grown local variety, known as *Jari*, gave the largest outturn, but its produce was valued by the Manager of the Empress Mills at only Rs 5 per bojha of 345lb, as against Rs 9 for the American varieties, and Rs 7 for local *Bani*. Having regard to quality as well as to quantity of outturn, the Upland Georgian and the American variety known as *Allen* show best. In the previous year local *Jari* more than compensated for the low value of its produce by the quantity of its yield. This was not the case in 1891, but the outturns are, all through, too small to warrant definite conclusions.

"The experiments of both years show clearly that local *Jari* is the most paying kind for the ryot, unless he is allowed by the middlemen to obtain the full value of higher class cottons, which, I have been assured, is rarely the case."

And a similar expression of opinion is found at page 12 of the Report for 1892-93:—

"In both experiments the *Jari* variety shows best, its larger outturn compensating for its lower value; the value of the *Bani* crop is, however, but very little behind. *Jari* is the short-stapled cotton commonly sown in the neighbourhood; whereas *Bani*, though also a local variety, is of much finer quality. *Jari* produce is of comparatively low value, being priced at Rs 8 per bojha of 345lb, whereas the other varieties are all valued at Rs 10 by the Manager of the Empress Mills."

12. In 1886-87 it was decided to endeavour to raise a stock of pedigree wheat. The local varieties called "*haura*" (hard white), and "*pissi*" (soft white), and "*katha*" (hard red) were sown on some good land and at harvest the best and largest ears selected and retained for sowing in the next cold weather. In this way it is hoped that the quality of the grain will improve.

There seems to be some ground for believing that this experiment may be fruitful. The Report of 1889-90 contains the following statement:—

	AVERAGE WEIGHT OF ONE PAILI.				MARKET VALUE OF ONE KHANDI.	
	Pedigree.	Ordinary.	Pedigree.	Ordinary.		
<i>Haura</i>	2 10 ³	2 9 ³	12 4 0	11 14 0		
<i>Pissi</i>	2 10 ³	2 9 ³	12 0 0	11 8 0		
<i>Katha</i>	2 10 ³	2 10	11 8 0	11 4 0		

13. It is probable that more immediate good will be done at Experimental Farms in the matter of improving the quality of seed than in other directions, and this part of the work may well be pushed. Different varieties of cotton, including Upland Georgian, are still being grown, but the annual distribution of Upland Georgian seed has ceased.

The American Maize seed was appreciated by the Kachis, but judging by some cobs which I saw in their village, it has deteriorated, probably by cross fertilisation with small varieties. Some of the American sorts might be annually grown for seed and the seed sold. The Maize usually culti-

Maize.

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vated in the Jaunpur District, North-Western Provinces, is also a superior sort and might be likewise introduced on the Nagpore Farm.

Another crop, which it might be worth while to grow, is the large description of *bajri* (*Pennisetum typhoideum*) which is cultivated in Gujerat.

The experiment with pedigree wheat is being continued, as also are those with the white and brown varieties of linseed. In all such experiments specimens of the original as well as samples of each year's crop should be kept for future comparison.

Moreover, it would be well to obtain new stocks of seed from the original source every few years.

(b) The comparative value of different manures.

14. With the exception of the manures employed in one experiment (the Ville Series) the manures employed have all been of a very "practical" description. Bone Dust, Saltpetre, Dung and Box Dung, Poudrette, Green Manuring with hemp, *tarota*,* *Psoralia corylifolia*, have been experimented with for a variety of crops. Whilst many of the experiments have been, however, of a very temporary description, there are a few which deserve a careful scrutiny, since they have been persevered with through a series of years.

15. What is called the Ville Series of plots, consists of a series of six, one of which is manured with a "complete" manure, consisting of Ammonium Chloride, Superphosphate of Lime, Sulphate of Potash, Sulphate of Lime, and thus contains all those essential elements of plant-food which are generally present in the soil in small, and frequently in deficient, proportions.

Four of the other plots also receive certain of the above-named manurial substances, one of the essential plant-foods being eliminated from the mixture for each plot. Thus plot 2 receives no Phosphate, and here the Superphosphate of lime is excluded, whilst the Ammonium Chloride, Sulphate of Potash and Sulphate of Lime are employed.

Plot 3 again receives no Nitrogen, therefore the Ammonium Chloride is omitted from the mixture.

There is also a plot to which no manure is added.†

16. The experiment was originally recommended as a method of determining whether a particular soil was deficient in some one or several of these plant-foods.

Later teachings of experimental agriculture have shown that a certain plant-food may affect two crops in the same soil quite differently. No better illustration of this fact could be given than the different effects of Nitrogenous and Phosphatic manures on the cereal and root crops (in Europe). The cereal crops are particularly influenced by the application of a Nitrogenous manure, whilst the root crops are especially improved by a Phosphatic manure, and these effects are noticeable whether the soil be a clayey or a sandy one.

At the Experimental Farms at Cawnpur, Dumraon and Burdwan a corresponding result has been obtained in the case of cereal crops, these having responded particularly to a Nitrogenous manure, whilst bones (Phosphates) have had little effect in increasing the outturn. Roots have not yet been very successfully grown.

Series.

* *Tarota* is the vernacular name of *Cassia auriculata*.—Ed.

† On Plot 6 the Calcic Sulphate was omitted, the idea being to eliminate this substance from the mixture on this plot. But since the Superphosphate employed contained probably nearly as much Calcic Sulphate as the Gypsum which was applied to all other plots, the effect of omitting the Gypsum on this plot was really only a reduction of the amount of this substance in the manure, and not its total elimination.

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17. In the case of the experiments made at the Nagpore Farm wheat was the crop grown and one might have anticipated that the effects of Nitrogenous manure—Ammonic Chloride—would have been demonstrated. Although the results have not been very concordant, they indicate that the effect of Nitrogen on the wheat crop in black soil is considerably greater than that of the other plant-foods. The figures in the following statement are the average outturns of wheat obtained for the five years, 1883-84 to 1887-88. Since then the plots have been altered twice with the object of obtaining more regular results:—

I.	II.	III.	IV.	V.	VI.
Ammonic Chloride, Superphosphate of Lime, Potassic Sulphate, Calcic Sulphate.	Ammonic Chloride, Potassic Sulphate, Calcic Sulphate (no Phosphate).	Superphosphate of Lime, Potassic Sulphate, Calcic Sulphate (no Nitrogen).	No manure.	Ammonic Chloride, Superphosphate of Lime, Sulphate of Lime (no Potash).	Ammonic Chloride, Superphosphate of Lime, Potassic Sulphate.
lb	lb	lb	lb	lb	lb
1,514	1,537	1,198	1,039	1,284	1,213

The manures would, from the ryot's point of view, be called unpractical, but as an illustration for the benefit of the students at the Agricultural School it should prove valuable.

18. The "A", "B" and "C" Series of plots. Perhaps the most practical and at the same time the most uniformly-made experiments with manures at this Farm have been carried out on three series of plots named respectively "A", "B" and "C". Each series consists of eight plots, to six of which Nitrate of Potash (saltpetre), bone dust, saltpetre and bone dust, cattle dung, cattle dung and bone dust, Ashes of cattle dung are applied as manures. On a seventh plot a crop of "San hemp" (*Crotalaria juncea*) is grown in the monsoon, and then cut down and ploughed in as a "green manure". Lastly, a plot is left unmanured.

"A" Series was commenced in 1884 and has been carried out regularly ever since. There are thus nine years' results recorded. Wheat is the crop grown and no artificial irrigation is employed.

"C" Series was a duplicate of "A" and was continued from 1884-85 until 1889-90. The two series provide, therefore, the results of six years. Wheat was here also the crop cultivated and without irrigation.

"B" Series of plots has been manured in a similar manner since 1885-86, but the crops cultivated have varied. Since 1890-91 wheat has been the crop grown, but irrigation has been introduced into the experiment. Together, therefore, these three series of plots should provide an index as to the comparative value of these manures for the wheat crop. Had it not been for the attacks of rust which have interfered continuously with so many of the experiments at Nagpore, this result would doubtless have been attained, but the effect of this disease has been to interfere most seriously with the experiments, and only general deductions can be drawn.

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19. I have recently compared the results obtained at several of the Experimental Farms regarding the value of Cattle Dung and "Green Manure" for cereal crops and have put the information, thus attainable, together in the form of two notes which have appeared in the *Agricultural Ledger*, Nos. 20 of 1893 and 3 of 1894.

It will be unnecessary for me, therefore, to again enter into the details of the results obtained with Cattle Dung.

20. *Green Manuring*.—This term is applied to a practice which is not unknown in different parts of India, though it is not generally employed. It consists in growing a crop, generally a leguminous one, and ploughing it in whilst still green. This acts as a manure for the following crop.

The crops which have been thus utilised at Nagpore are *San Hemp* (*Crotalaria juncea*), "*tarota*" or (*Cassia auriculata*) and *Psoralea corylifolia*.

The crops for which this system of manuring has been applied were wheat, linseed, and more recently cotton. All the experiments with manures for wheat and linseed have been vitiated more or less by attacks of either rust or "*talap*", and consequently for this system of manuring the data obtained are not as uniform as might have been wished. Moreover, on unirrigated land, it is necessary not only to grow the green crop, but likewise to have sufficient additional rain after it is ploughed in, to cause its decomposition. In some years there has been a deficiency of late rains and the green crop has remained more or less undecomposed in the soil.

In the second part of the note on the value of Cattle Dung I have tabulated the outturns of wheat obtained at Nagpore by ploughing in *San Hemp*. The results there embodied belong to the "A", "B" and "C" Series of experiments which have been carried out systematically during a series of years. Results obtained in other experiments have been, on the whole, more favourable to the method, but the previous treatment of the land was not regular and the figures are consequently not sufficiently reliable for basing calculations upon. The method is still being tested in several of the present experiments, and more trustworthy information may be gained in the course of a few years.

21. Since this means of manuring land entails the provision of both seed and labour, it is necessary to estimate, as far as may be, its probable cost to the cultivator.

In my note(already referred to) I have (paragraph 14) explained that I think it a method well within the means of an ordinary cultivator. In the Reports of the Nagpore Farm I find estimates of its cost given. Two of these may be quoted. The one will be found at page 7 of the Report for 1886-87 and amounts to $R3\cdot13$ per acre, the other is stated at page 29 of the Report for 1890-91 and amounts to $R9\cdot8\cdot6$ per acre. The former rate would show the method to be within the means of the cultivator; the latter would show it to be too expensive.

At Cawnpur the cost is stated at $R2$ per acre. It always appears to me to be an extremely difficult thing to fix money values of this nature. If a ryot has to pay for anything in silver, the valuations may be considered legitimate, but where it is merely a matter which will occasion him a little extra labour, I think misleading to pit against it the cost entailed to Government on an Experimental Farm. This process of green manuring would probably cost the cultivator no ready money at all: the seed could be easily grown on a small plot and the labour amounts to about an extra ploughing *plus* the time required to cut down the crop.

The above estimates have reference to the *San hemp* crop. *Psoralea corylifolia* does not require to be cut down and may be ploughed in straight away.

Green
Manuring.

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22. The value of Saltpetre as a Nitrogenous manure for almost all crops has been recognised for a long time in Europe, and although it is generally classed as an "artificial" manure, it very properly has found a place among the experiments at the Nagpore Farm. I give below the annual outturns of wheat in pound per acre of the plots Nos. 1 and 7 of the "A" Series, of which No. 1 received annually 240lb of Saltpetre per acre, whilst No. 7 is the "no manure" plot :—

	1884-85.	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.	1890-91.	1891-92.	1892-93.
	lb.								
No. 1.—Saltpetre 240lb per acre . . .	1,555	990	1,610	1,470	610	687	1,227	612	420
No. 7.—No manure .	1,055	763	1,060	760	525	887	515	450	230

Similar results were obtained on the corresponding plots of the "C" Series.

Its value as a manure for wheat is here again demonstrated. The experiments which have been made at the Cawnpur Farm for twelve years with this substance as a manure for wheat and maize have given a like result, and it may, therefore, be confidently stated to be a valuable manure for cereals in India as in Europe. Its price is unfortunately high, being about R10 per maund, for the pure Saltpetre.

It may not be necessary to apply so much as 3 maunds per acre, and in another experiment at Nagpore only 1 maund is being applied.

For cereals in England it is employed at the rate of 2 to 3 cwt. per acre.

23. Bones finely crushed have been applied as manure for several of the crops on the farm every year, but the only systematic experiment which has been made with it is on Plot 2 of the "A" Series in which wheat is the crop cultivated.

The following statement shows the results :—

	1884-85.	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.	1890-91.	1891-92.	1892-93.
	Plot 2.—Bone dust at 360lb per acre .	Plot 7.—No manure.							
	1,067	635	1,340	948	695	845	685	567	267
	1,055	763	1,060	760	525	887	515	450	230

Thus it will be seen that this manure has generally produced an increase of crop.

The cost of collecting bones for the farm amounts to annas 4 per maund and for crushing to annas 12 per maund; the 360lb thus costing R3-6.

24. The experiments with different manures have been practical and useful.

I have mentioned in paragraph 17 that the Ville Series is useful, more particularly for the students. Mr. Joshi, the Superintendent of the Farm,

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has suggested to me the desirability of growing linseed instead of wheat in this experiment, and I think the suggestion might well be carried out. It would introduce a new natural order of plants into the experiment.

The "A" and "B" Series are very properly being continued. It might be advisable to start a somewhat similar series of plots for linseed. If this were done, I would recommend that on plots 3 and 5 green crops should be ploughed in instead of the bone dust and saltpetre, and bone dust and dung, which are at present applied in experiments "A" and "B".

The two plots Nos. 3 and 5 might be manured with *tarota* and *Psoralea corylifolia* in the new experiment and we should thus have three plots "Green manured."

Further than this I would not recommend any alterations under this section of the experimental work.

25. (c) *Implements*.—A number of implements of a more or less novel character have been tested in different years. Among these the following may be mentioned:—

"Cook's Sugar Juice Evaporator," a shallow vessel which has worked as well at Nagpore as it has done at Cawnpur. It is intended for the manufacture of crystallised sugar and is unfitted for the making of *gur*. It can be made locally for about R40.

Several threshing machines, including Mayfarth's Hand-thresher, Hubner's Little Giant bullock power thresher and cleaner, and Ransome's bullock power thresher, have been tested for a number of years and are all far cleaner and more expeditious than the method of treading out the grain by bullocks.

It is difficult to make a comparison of the cost of these machines with that of treading out the corn by bullocks, but even if no cost be allowed for the bullocks, it is doubtful whether these machines are not cheaper than treading out. Moreover the grain comes out much cleaner and of better appearance.

Dell's Hand-winner is also frequently borrowed by the cultivators.

Several descriptions of the Iron plough have been tested and the "Swedish" plough has shown itself useful. It is used by the Kachi cultivators in the neighbourhood. Its draught is no greater than that of the country "nagar" and it does the work in half the time. Some have been sold.

Mr. Joshi has replaced the bamboo tubes of the ordinary native drill with iron ones, at the expense of a few annas. These have been found to work well for most seed, but they proved useless for cotton seed, which, even after treatment with cow dung, was caught in the iron tube. As it requires a woman for each tube of the native cotton drill, it would save a lot of labour if tubes could be introduced which would allow the cotton seed to pass freely, in which case the seed could be "served" by one person. With this object I have suggested to Mr. Joshi that if the iron tubes were internally coated with paint and then varnished, their surface would be so smooth that the seed might pass.

I have also suggested that if a "marker" could be added to the native drill to draw a line, down which the drill should pass on its return journey, the distances between third and fourth lines (in the case of a three-row drill) would be uniform, and weeding with the "dhundia" or the "dhaura" would be much simplified.

The "marker" would act in the same way as the one usually employed at home when preparing the land for sowing potatoes.

26. (d) *Methods of Cultivation*.—Under this heading come principally "rotation" of crops and mixtures of crops. This subject has been taken

Implements.

Threshing machines.

Ploughs.

Seed drills.

Methods of cultivation.

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**The effect of
trees on the
neighbouring
crops.**

up systematically during the last few years only, and there has not been sufficient time to provide reliable data from which to draw conclusions.

The experiments have been instituted in order to determine, if possible, the *raison d'être* of a number of the cultivators' practices.

One method of cultivation distinct from the above, is that of embanking the land, which is general in the Northern Districts of the Provinces. It has been tried for a number of years at Nagpore for the wheat crop, but there proved an entire failure.

27. Another experiment instituted by Mr. Fuller is well worthy of note. It is a matter of common observation that crops frequently fail partially or wholly to grow in the immediate neighbourhood of trees. The usual explanation has been, that the "shade" prevents vigorous growth, or, again, it has been stated that the drippings of rain water from the trees cause the damage. It occurred to Mr. Fuller that it might be the surface roots of the trees which were the real source of harm; that especially during the period of active growth they drained the soil of its available plant-food to the detriment of the crops it was desired to cultivate.

In order to solve this question, a trench some two feet deep was dug alongside a row of mango trees and bamboos which had apparently prevented the healthy growth for some distance away from them. Their surface roots were thus cut through with the immediate result that crops could be grown right up to the edge of the trench. I believe that Mr. Fuller has thus explained a question which affects Agriculture, not only in India but also in other parts of the world.

28. In 1892 a number of Kachis from the Cawnpur District were imported to show the cultivators around Nagpore the manurial value of Night-soil. They were provided with land close to the farm and a portion of the town Night-soil and road-sweepings were deposited in pits measuring 10' x 4' x 4' deep. The pits are partially filled with the Night-soil and sweepings and then earth is spread over the top. It is found that at the end of 12 months a fairly odourless *poudrette* results.

Irrigation water for the Kachis is provided by a small channel from the Ambajhari Reservoir.

The cultivators pay a rent of Rs 20 per acre *plus* a water rate of annas 8 for each watering. They cultivate 23 acres. The experiment has not only been successful in putting to its proper use some of the town Night-soil and sweepings, but the neighbouring Kunbi cultivators have also commenced to use the *poudrette*.

29. In connection with this part of the work, it has occurred to me that the system which has been adopted at the Allahabad Grass Farm for the disposal of Night-soil might also be tried experimentally at Nagpore. The method, as will appear from the following extract from the Allahabad Grass Farm Report for 1892-93, is extremely simple. It entails the temporary use of a much larger area of land than does the "pit" system at present practised at Nagpore, but if it works as well at other places as it has done at Allahabad, I feel sure there will be no difficulty in obtaining land for the purpose. It has the great advantage of not requiring that the material shall be ploughed after being once deposited, and it is doubtless also the case that the processes of oxidation proceed much more rapidly than they do when the material is buried deep.

I saw some land recently (August) at Allahabad which was being thus used, and, although in the monsoon, the earth was almost odourless at the end of a week. I am told that in the dry weather there are hardly any odours at all from the land immediately after the earth has been strewn over. The land should, I think, be allowed to lie fallow for several

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months after depositing the Night-soil, and it is also probable that the same land should be manured in this manner only once in five or ten years. Experience, however, of the method is required before a definite opinion can be formed on these points.

(Extract from letter from the Principal Medical Officer, Allahabad District.)

"At the Allahabad Grass Farm the following system, devised by Conductor Meagher, has been found to answer best. For the contents of each filth cart, a rectangular space 14' x 5' is taken and the top soil scraped off to the edges to a depth of about 3". The soil at the bottom of the space is then loosened and pulverized to a depth of 6" or 7". The shallow trench having been thus prepared the contents of the filth carts (Crowley Pattern) are tipped into it. If the bottom soil has been well pulverized, the fluid portion soaks into it quickly, leaving a thin stratum of the solids on the top, which is now covered over with 3" of earth first removed. The shallow trenches are prepared in succession, leaving a space of about 4" between them."

30. An open piece of land on the top of a low (basalt) hill at Telenghari has been recently taken up by the Commissioner of Settlements and Agriculture with a view of converting it into a fuel reserve. Babul, "Khair," teak, bamboo, sal, have been sown in lines at several places within the area, and the babul and "khair" are especially giving promise of success. One portion of the land was planted with "ber" by the Forest Department some years ago.

The soil is doubtless thin and very stony, and this will probably form a stumbling-block to the work.

But although difficulties will be encountered in growing trees on such poor soil, the experiment should be prosecuted and given a fair trial.

In the meantime the cattle are a source of considerable mischief, and I found numbers of young trees nibbled off. Mr. Joshi, the Farm Superintendent, has prosecuted two of the owners, but the only satisfaction obtained was a fine of Rs 2, and, as he said to me, "These *gudhās* don't mind such a punishment. It represents the sum they pay for the food of their cattle for a long time."

As long as open grazing is permitted, so long will it be futile to attempt to provide fire-wood, and the owners of cattle, who deliberately turn their cattle loose at night to graze where they please, should be punished in a manner commensurate with the damage which they cause. I see it mentioned in one of the Farm Reports that they go at night into the farm fields, and I am informed that the same practice exists in the case of cultivators' land.

So far as the Telenghari Reserve is concerned, I would recommend that a fence of "prickly pear" be put down as fast as may be possible. It would, I am informed, be very expensive to hedge in the whole area, and that being the case, I would suggest that the areas on which trees have been actually planted might be first enclosed.

31. I do not place so much value on this attempt to establish a fuel reserve at Nagpore, merely for the purpose of providing Nagpore with fuel. I value it more because of the fact that at present we are almost without data as to the amount of fuel which may be obtained off a given area, and we are totally without information as to the ryots' requirements in the way of wood. We are also equally ignorant as to the most suitable trees to grow for the purpose. It is for these reasons that I think it specially important to establish fuel reserves wherever the necessary

The Telenghari Fuel Reserve.

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supervision can be provided, and I hope that, though the difficulties may be great at Telenghari, the experiment may be persevered in for some years.

32. *The Agricultural School.*—This was established in 1888 as a part of the Chief Commissioner's scheme for Technical Education and has since continued to work satisfactorily.

The number of students has varied somewhat, but, as a rule, about a score have been in attendance.

The course of study extends over two years and includes the following subjects:—

Chemistry, Botany, Geology, the Principles of Agriculture, Practical Agriculture in the field, Surveying and Veterinary Surgery (Practical).

A vernacular class for masters of the Primary Schools was established in 1891, for which a six months' course of instruction is provided.

33. Dr. Voelcker visited the school in 1890 and his remarks upon it will be found at page 26 of the Report for 1890-91, and also paragraph 524 of his Report on Indian Agriculture. Mr. Benson, Assistant Director of Agriculture, Madras, also visited the school in 1890, and his criticism of it will be found at page 28 of the Farm Report of 1890-91.

I entirely agree with both these gentlemen in thinking that the school is doing good. The course of education is not too extensive nor too advanced, and I found the students quite able to answer most of the questions I put to them. The practical work both in Agriculture, Surveying and Veterinary Surgery is an undoubted advantage.

34. Regarding the "two years' course" the only disappointment appears to me to be that only a portion of the students who have been adjudged qualified in the Final Examination are able to find employment.

It is acknowledged by Mr. Fuller (paragraph 8 of his Review of the work of the Farm for 1892-93) that the students attend with the express idea of getting into Government employ.

This would appear to be an old story in India, and whilst one might wish it were otherwise, it may also be fairly noted that the majority of those who go to Agricultural Colleges at home or on the Continent do so with the express purpose of obtaining employment. Some are the sons of landed proprietors, but there is a large proportion who are drafted into Surveyors' and Land Agents' Offices. Thus, to a certain extent, the students may be sympathised with in hoping to obtain Government employment, since no other openings are at present available. Moreover, as Dr. Voelcker in paragraph 506 of his Report says in reference to this part of the subject:—"I do not think there is much likelihood of a change, and therefore it is better to provide for things as we find them and not as they might be."

On enquiry I found that some of the passed students had obtained employment in the Revenue Department, but that they had not been employed in the Educational Department, and only one had been employed on an estate.

It occurs to me that they might be found useful in both these directions.

35. In reference to the latter, namely, the Educational Department, I think that the best way in which their services might be utilised would be to make them peripatetic teachers of the subjects I will presently specify for a number of schools, allotting, say, 5 or 6 to each teacher and thus employing them entirely in this special work.

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Experimental Farm. (J. W. Leather.)

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I make the suggestion because I fear that if they had to teach a very little agriculture and a great deal of something else, the agriculture would soon become a secondary matter with them, they would become "rusty" in it, and finally get out of it altogether. The scheme would thus end in failure.

There is also another thing which I would suggest if the plan were considered workable, and that is that those who were thus drafted into the Educational Department should not be allowed to cease all connection with the Agricultural School at Nagpore, but that they should attend it for a certain portion of each year for, say, the first five years after entering the Educational Department.

The course of education at the school is only a two years' one, and I feel sure that they would do very much better by having to, thus constantly for a series of years, revise the teachings of that course, instead of becoming "rusty" in those portions of it which they may not be called upon to teach in the schools. The subjects which I would suggest as suitable for the schools are (1) Principles of Agriculture, (2) Structural Botany (with especial reference to the farm crops of the immediate neighbourhood), (3) Entomology, with especial reference to the insects of the neighbourhood, (4) Surveying. I leave out Chemistry purposely. I do not think that any good can be done by teaching it without a proper Laboratory and a larger amount of time than could probably be allotted to agriculture. If, however, these desiderata could be provided, it would be well to permit its inclusion in the syllabus. All the above-named four subjects might and should be taught practically, and the examination should be such as to show that this had been properly carried out.

36. In making this proposal I do not wish to suggest the discontinuance of the six months' Vernacular class for teachers, which is already in existence at the Nagpore School. Not only in India, but likewise at home, our experience in the teaching of the principles of Agriculture in Elementary Schools is extremely limited, and I do not think we can consider any scheme which might be proposed in any other light than that of an experiment. This one of sending the ordinary village school-masters to Nagpore should therefore by no means be interrupted; it should be continued until some definite conclusion as to its merits has been arrived at. Personally, I have a doubt as to its success, and it is for this reason that I make the proposal of testing the usefulness of the "two-years" students of the Nagpore School also for Agricultural Education. I would not propose any large scheme, but would suggest that two or three such appointments be created each year for about ten years, and the results carefully noted.

37. The other direction in which I think these students might be employed is on estates. Could they not be found useful as assistants to those who have charge of Court of Wards' Estates? Whilst I am well aware that it is difficult to teach the ryt his business, I am also of the opinion that there is considerable room for the introduction of improvements on large estates. How often, for instance, do we find good land cut up into ravines, simply because the land happens to be the common grazing ground, which Zemindars think to be not worth protecting. Or, again, how often has Government spent money in the distribution of new seed to cultivators, with the only result that when an answer was required as to its suitability or success, it has been found that no reliable information could be obtained, or that the new seed had been deliberately mixed with other (local) seed.

In throwing out these as examples of possible improvements on

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Zemindari Estates, I do not wish it to be thought that I consider these youths capable of working independently of more experienced guidance. If they are to be successfully employed in this direction, I feel sure that they should act rather in the capacity of assistants to the Manager of the Estate. In the case of the Court of Wards' Estates, would they not be of service to the Deputy Commissioner in charge? It will I know be readily acknowledged that the Indian Zemindar might manage his estates better than he does and introduce improvements; and I have no hesitation in saying that if they paid a fair attention to this duty, they would find well-educated assistants quite a necessity. Their utility might in the meantime be demonstrated on Court of Wards' Estates.

The above are two directions at least in which I think these students might be provided with employment.

Conclusion.

38. I visited the Nagpore Farm on two occasions, namely, March 12th-17th and August 28th to September 4th, 1894. I have commented on the several experiments which have been made and on the Agricultural class, and I need only say here that I consider the work is being carried on in a thoroughly capable manner.

I would especially refer to the present Superintendent, Mr. Joshi, who unquestionably takes a very great interest in all the various departments of the work, and he is, moreover, fully qualified for it. It was no small pleasure to me to be conducted over the farm by some one who did not require to turn either to his subordinates or to his note-books before he could answer the questions I put to him.

39. One subject only remains to be referred to, and that is the Annual Report. This has been made the subject of a communication, which I have recently, at the instance of the Secretary to the Government of India, addressed to the Commissioner of Settlements and Agriculture. I have taken the opportunity, which my visit to Nagpore has afforded, of discussing this matter with Mr. Graddock, the present Officiating Commissioner of Settlements and Agriculture, and I have explained to him that I think each year's Report should not only be a Report of that particular year's work, but that it should be kept up to date and that one should be able to see the results of each of the previous year's results of any experiment without wading through all the different previous Reports. It should also be annually drawn up in a uniform manner and not re-arranged each year. I am of opinion too, as was Dr. Voelcker, that the question of cost would be better left until the experiment has given some definite answer to the question raised.

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series ; those on Forestry in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

This sheet and the title-page may be removed when the subject-matter is filed in its proper place according to the letter and number shown at the bottom of each page.